

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 6317P070PCT	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2004/022347	International filing date (<i>day/month/year</i>) 12 July 2004 (12.07.2004)	Priority date (<i>day/month/year</i>) 11 July 2003 (11.07.2003)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant APPLIED MATERIALS ISRAEL, LTD.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input checked="" type="checkbox"/> | Box No. VIII | Certain observations on the international application |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Date of issuance of this report 16 January 2006 (16.01.2006)
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Form PCT/IB/373 (January 2004)	Telephone No. +41 22 338 90 90

REC'D 31 AUG 2005

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To:

see form PCT/ISA/220

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

Date of mailing

(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCTUS2004/022347

International filing date (day/month/year)
12.07.2004

Priority date (day/month/year)
11.07.2003

International Patent Classification (IPC) or both national classification and IPC
G01B15/04, H01J37/28, G01R31/305

Applicant

APPLIED MATERIALS ISRAEL, LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2004/022347

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	9-14, 25-36, 45
	No: Claims	1-8, 15, 17, 20-24, 37-39, 41-44
Inventive step (IS)	Yes: Claims	9-14, 25-36, 45
	No: Claims	1-8, 15, 17, 20-24, 37-39, 41-44
Industrial applicability (IA)	Yes: Claims	1-45
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following document/s/:

D1: US-A1-2002/0179812

D2: WO-A1-01/45136

1. Remark:

It is unclear in **Claims 1, 9, 15, 25, 37, 42 and 45** whether the second portion and the first portion of a structure are different pieces of a structure or whether these refer to the same part of a structure measured from different angles, Article 6 PCT, (see item VIII).

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of **Claims 1, 15, 37 and 42** is not new in the sense of Article 33(2) PCT.

2.1 The document D1 discloses (see e.g. Claim 11):

A method for determining a cross sectional feature of a measured structural element having a sub-micron cross section (Para.0007), the cross section is defined by an intermediate section that is located between a first and a second traverse sections, the method comprising the steps of: scanning, at a first tilt state, a first portion of a reference element and at least the first and second traverse sections of the measured structural element (in D1 the whole element is scanned), to determine a first relationship between the reference structural element and the first traverse section; scanning, at a second tilt state, a second portion of a reference element and at least the second traverse section of the measured structural element, to determine a second relationship between the reference structural element and the second traverse section; and determining a cross sectional feature of the measured structural element in response to the first and second relationships.

In D1 a reference structure is measured first at two angular positions and the sample afterwards in two angular positions, however, this order appears not to be excluded by the wording of present Claim 1. Therefore, the subject-matter of **Claim 1** is not new, Article 33(2) PCT.

2.2 Claims 2-8, which depend on Claim 1, do not contain any features which, in combination with the features of Claim 1, meet the requirements of the PCT in respect of novelty and/or

inventive step:

Claim 2 The relationship is a distance (D1: para.0023, Claim 5).

Claim 3 The reference and the measured element are in the same plane (D2: Fig.2).

Claim 4 The height of marks formed by an electron beam (D1: para 0124) must be small if these are formed in a time suitable for carrying out the measurement process.

Claim 5 Reference elements are formed near the measured element (D1: Claim 20).

Claim 6 Scanning at substantially ninety degrees is well known (D2: page 6, lines 23-25).

Claim 7 Additional elements are implicit of the repeating structure (D2: page 8, lines 12-14).

Claim 8 It is obvious to make use of all the collected data.

2.3 A portion implicitly consists of at least one point: It may be assumed from Claim 11 of D1 the that entirety of the target visible to the beam will be scanned, therefore depending on the angle of incidence several portions or points of the reference template will be scanned. At the second tilt angle second points and portions will be available to the incident beam, which may or may not be identical with the first points and portions. The subject-matter of **Claim 15** is therefore also not new, Article 33(2) PCT.

2.4 Claims 17 and 20-24, which depend on Claim 15, do not contain any features which, in combination with the features of claim 15, meet the requirements of the PCT in respect of novelty and/or inventive step:

Claim 17 Measurements of the positions of reference marks is implicit of the method in Claim 18 of D1.

Claim 20 Elements of lines or trenches with opposing walls are known (D2: page 8, lines 12-14).

Claim 21 The structural element is a contact (D2: page 13, lines 17-20).

Claim 22 See Claim 20.

Claim 23 See Claim 7.

Claim 24 See Claim 8.

2.5 The document D2 discloses (see in particular Fig.2 and Claims 1, 7 and 13):

A method for determining a cross sectional feature of a measured structural element (Claim 13) having a sub-micron cross section (Page 2, lines 1 - 3), the cross section is defined by an intermediate section that is located between a first and a second traverse sections, the method comprising the steps of: scanning, at a first tilt state (Claim 1, part a), a first portion of a reference structural element (Fig.2, Ref.40) and at least the first traverse section of the measured structural element, to determine a first relationship between the reference structural element (Claim 14) and the first traverse section; scanning, at a second tilt state, a second portion of a reference structural element (Claim 14) and at least the second traverse section of the measured structural element (Claim 1, part c), to determine a second relationship between the reference structural element and the second traverse section; and determining a cross sectional feature of the measured structural element in response to the first and second relationships (Claims 13 and 14).

Therefore, for the same reasons as in point 2.3 above, and with respect to page 8, lines 9-20 of D2, the subject-matter of **Claim 37** is not new, Article 33(1) PCT.

2.6 Claims 38, 39 and 41, which depend on Claim 37, do not contain any features which, in combination with the features of claim 37, meet the requirements of the PCT in respect of novelty and/or inventive step:

Claim 38 Statistical processing of multiple measurements is obvious in the art.

Claim 39 See Claim 38.

Claim 41 The reference element is at one side of the sample (D2: Fig.2).

2.7 Note that the subject-matter of Claims 1 and 15 is also not new with respect to D2.

- 2.8 Both D1 and D2 disclose apparatus which can be used for carrying out the methods of Claims 1, 15 and 37, as set out in points 2.1, 2.3 and 2.5 above.

Therefore, the subject-matter of Claim 42 is not new, Article 33(2) PCT.

- 2.9 Claims 43 and 44, which depend on Claim 42, do not contain any features which, in combination with the features of claim 42, meet the requirements of the PCT in respect of novelty and/or inventive step:

Claim 43 The two tilt states of D1 (Claim 11) produce two relationships to the reference.

Claim 44 The processor of D1 must also be capable of determining the cross-section in response to the multiple scan data it receives.

3. Regarding document D1 as the closest prior art to the subject-matter of **Claims 9 and 25**, it differs from the present application in that it is not determined from the scan of the first tilt state whether to perform additional scans at a second tilt state.

The subject-matter of claims 9 and 25 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as improving the performance and speed of the process of determining the cross-section of a structure.

The solution to this problem proposed in claims 9 or 25 of the present application is considered as involving an inventive step (Article 33(3) PCT) as it is not rendered obvious by any of the documents cited on the search report that the process may be improved in this method.

Claims 10-14 and 26-36 are dependent on claims 9 and 25 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

4. The combination of the features of dependent **Claims 16, 18 and 27 - 30** is neither known from, nor rendered obvious by, the available prior art: Claims 16 and 18: positioning reference structures either side of the measured structure; Claims 27-30: the decision to perform an additional scan based on width, orientation, cross-section and threshold of the traverse.

Re Item VII

5. In order to meet the requirements of Rule 5.1.a.ii the relevant state of the art should be identified in the description.

Re Item VIII.

6. **Claims 1, 9, 15, 25, 37, 42 and 45** are unclear, see point 1.